TREMATODES FROM AUSTRALIAN BIRDS
I CORMORANTS AND DARTERS

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Introduction

The earliest record of the presence of trematodes in Australian birds was by Krefft (1873), who reported *Distomum* spp. from two species of herons and from a coot from Eastern Australia. The first paper describing flukes from our birds was that published by S. J. Johnston (1904) giving an account of three species of *Holostomum* (from a gull, tern and heron, respectively) and two of *Hemistomum* (from a black swan and *Dacelo*, respectively), all of these having been obtained in New South Wales. T. H. Johnston (1910; 1912) referred to various bird parasites under broad generic terms, *e.g.*, *Echinostomum* and *Monostomum*. S. J. Johnston followed on (1913) with an account of two new species from North Queensland and a record of two already known species. In the following year Nicoll (1914 a; 1914 b) published two papers dealing with parasites from Northern Queensland birds, the first describing seven new species and recording one already known elsewhere, the second paper including eleven new species and four previously known elsewhere. In 1916 T. H. Johnston issued his census of the endoparasites recorded from Queensland animals, including birds (1916).

Next year S. J. Johnston published the most extensive paper that has yet appeared relating to flukes from Australian birds. It included the description of twenty-one species of trematodes and gave a list of recorded species (1917). The latter portion of this paper (p. 251-253) contains some errors and omissions which have been carried over into the work of later authors. He omitted to list *Notocotylus attenuatus* from *Anseranas semipalmata*, *Burhinus grallarius* and *Lobivanellus lobatus*; *Opisthorchis obsequens* from *Hieracidea orientalis*; and *Patagifer bilobus* from *Carphibis spinicollis*, these records having been published by Nicoll (1914), all from North Queensland; also *Patagifer bilobus* recorded from *Ibis molucca* by T. H. Johnston (1916) from Southern Queensland. *Strigea flosculus*, reported by Nicoll (1914) from *Podargus strigoides*, was listed by Johnston (1917, 253) under *Dacelo gigas* and omitted from its proper host. *Hemistomum triangulare* (= *Adenodiplostomum triangulare*) whose true host is *Dacelo gigas*, was placed under *Ninox maculata* in addition. It might be mentioned that these errors relate to three host species which follow each other in S. J. Johnston's list, and may have been due to accidental transposition of the lines during typing. He also referred (p. 251) to *Hemistomum triangulare* "parasitic in *Dacelo gigas* and *Ninox maculata* in New South Wales." In reply to my query, Professor E. A. Briggs of the Zoology Department of the University of Sydney, a member of the late Professor S. J. Johnston's staff, informed me that he could not locate any specimens of trematodes from these two hosts amongst the collections belonging to that department. The hosts are not related and they have different food habits. The record of *Adenodiplostomum triangulare* from *Ninox maculata* and *Strigea flosculus* from *Dacelo gigas* (which latter record Dubois (1938) has listed, following S. J. Johnston) should be deleted until corroborated.

Next year T. H. Johnston (1918) identified specifically the various trematodes which he had previously (1910, 1912, 1916) indicated under broad generic names. In 1921 Miss Chase described a Strigeid from a heron. Next year

Cleland (1922) published a paper which contained, amongst other parasites, a list of trematodes recorded from Australian birds, but as this was stated to have been based on S. J. Johnston's paper (1917), it includes the same errors as the latter's work. It was not till 1928 that the next contribution relating to our subject appeared, when T. H. Johnston described three species from *Gallinula*.

Dubois in 1937 (1937 a, 1937 b) published papers in which were described some Strigeids from Australian birds, and in his excellent monograph of the Strigeata (1938) he dealt with all known Australian species (except one) of the group. He included one of S. J. Johnston's erroneous references (p. 71, 480) relating to *Strigea flosculus*, and wrongly listed *Cardiocephalus musculosus* (Johnston 1904) under the Caspian tern, *Hydroprogne caspia*, whereas its host was *Sterna bergii*, the crested tern (p. 116, 481). In passing, it may be mentioned that Dubois in his monograph omitted mention of *Tetracotyle tiliquae* Nicoll. This metacercaria was obtained from the lizard, *Tiliqua scincoides*, and its adult stage will probably be found in an Australian hawk.

Miss Young (1939) published a list of helminth parasites recorded from Australia. Internal evidence indicates that her recording did not take cognisance of work published after 1937, in fact several papers which appeared in that year were omitted. The list is not critical and frequently the same host appears in two different places, since little attempt seems to have been made to give cross references to synonymy of hosts or parasites. The following records of parasites have been omitted: *Catatropis gallinulae*, *Echinostoma australe* and *E. bancrofti* described by T. H. Johnston (1918) from *Gallinula tenebrosa*; *Opisthorchis obsequens* by Nicoll (1914) from *Hieracidea orientalis*; and *Patagifer bilobus* recorded by T. H. Johnston (1916) from *Ibis molucca*. *Echinostoma australasianum* Nicoll is referred to as *E. australianum* (p. 61).

In 1940 Miss Goss described two species from Western Australian cormorants. In the same year Johnston and Simpson gave an account of the life history of the bird trematodes, *Leucochloridium australiense* (1904 a) and *Cyclocoelum jaenschi* (1940 b). Next year Johnston and Angel described the life history of *Diplostomum murrayense* from terns (1941 a), *Petasiger australis* from grebes (1941 b), and *Echinostomum revolutum* from various Australian ducks and the black swan (1941 c). An account of the life history of *Paryphostomum tenuicollis* from cormorants was published recently (Johnston and Angel, 1942).

The only records of the presence of trematodes in domesticated birds in Australia are: (1) *Prosthogonimus ovatus* (an error for *P. pellucidus*) by T. H. Johnston (1910, 116), based on a report by Spencer on the occurrence of trematodes in the egg of a domesticated fowl in Victoria (Proc. Roy. Soc. Vict., 1, 1888, 109); (2) *Echinostoma revolutum* from domestic ducks in Queensland by Roberts (1934, 5; 1939, 6). I now record *Echinoparyphium recurvatum* Linst. from a turkey in Melbourne (coll. Dr. A. W. Turner). The pigeon was proved to be capable of experimental infection with *Echinostoma revolutum* in Adelaide (Johnston and Angel, 1941 c).

I have been unable to trace the types and other material belonging to the avian species described by the late Professor S. J. Johnston in 1904. At that time he was economic zoologist to the Sydney Technological Museum. Mr. T. C. Roughley of that institution and Professor E. A. Briggs of the University of Sydney have not been able to locate them for me. Types of species described in S. J. Johnston's papers published in 1913 and 1917 are in the collections of the School of Public Health, Sydney (formerly the School of Tropical Medicine, Townsville, North Queensland), and the Australian Museum, Sydney, respectively. Nicoll's types (1914) were deposited in the former institution. All my early collections of trematodes were handed over to S. J. Johnston for study and formed part of the material described by him in 1917.

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Trematodes from Cormorants and Darters

There are five species of cormorants occurring in Australia, *Phalacrocorax carbo* (*novae-hollandiae*), *P. sulcirostris* (also known as *P. ater*), *P. melanoleucus*, *P. fuscescens* (*leucogaster; gouldi*), and *P. varius*, the last-named being restricted to coastal regions. *P. melanoleucus* appears to be by far the most common species occurring along rivers and swamps. Trematodes have been obtained from all these species, as well as from the only Australian species of darter, *Anhinga novae-hollandiae*.

Four species of trematodes have been described from Australian cormorants: (1) *Echinochasmus tenuicollis* S. J. Johnston 1917; (2) *Dolichosaccus solecarius* S. J. Johnston 1917; (3) *Paryphostomum phalacrocoracis* Goss 1940; and (4) *Diplostomum granulosum* Goss 1940; the first two were collected in New South Wales and the remainder from the Swan River, Western Australia. *Clinostomum australiense* S. J. Johnston 1917 was described from a Queensland darter. As a result of the present study, numbers (1) and (3) are placed as synonyms of *Paryphostomum radiatum* (Duj.); (2) has been assigned to a new genus, *Dolichosacculus;* and (4) has been found to be a synonym of *Hysteromorpha triloba* Rud. The occurrence of *Petasiger exaeretus* and *Echinoparyphium phalacrocoracis* in various Australian cormorants is now recorded, and a new species of *Stictodora* is described. Additional species have been collected, but their study is postponed for the present.

Miss Goss (1940) gave a brief account of an immature trematode found in *Phalacrocorax varius* from the Swan River. She considered it to belong probably to the Steringophoridae, and to be a parasite of some fish eaten by the bird. It seems to be a member of the Azygiidae near *Azygia*.

Clinostomum australiense S. J. Johnston

(Fig. 1-3)

This species from the oesophagus of a darter, *Plotus* (= *Anhinga*) *novae-hollandiae* from Eidsvold, Burnett River, Queensland, was described and figured by S. J. Johnston (1917, 230-234, fig. 17). An examination of the type slide and

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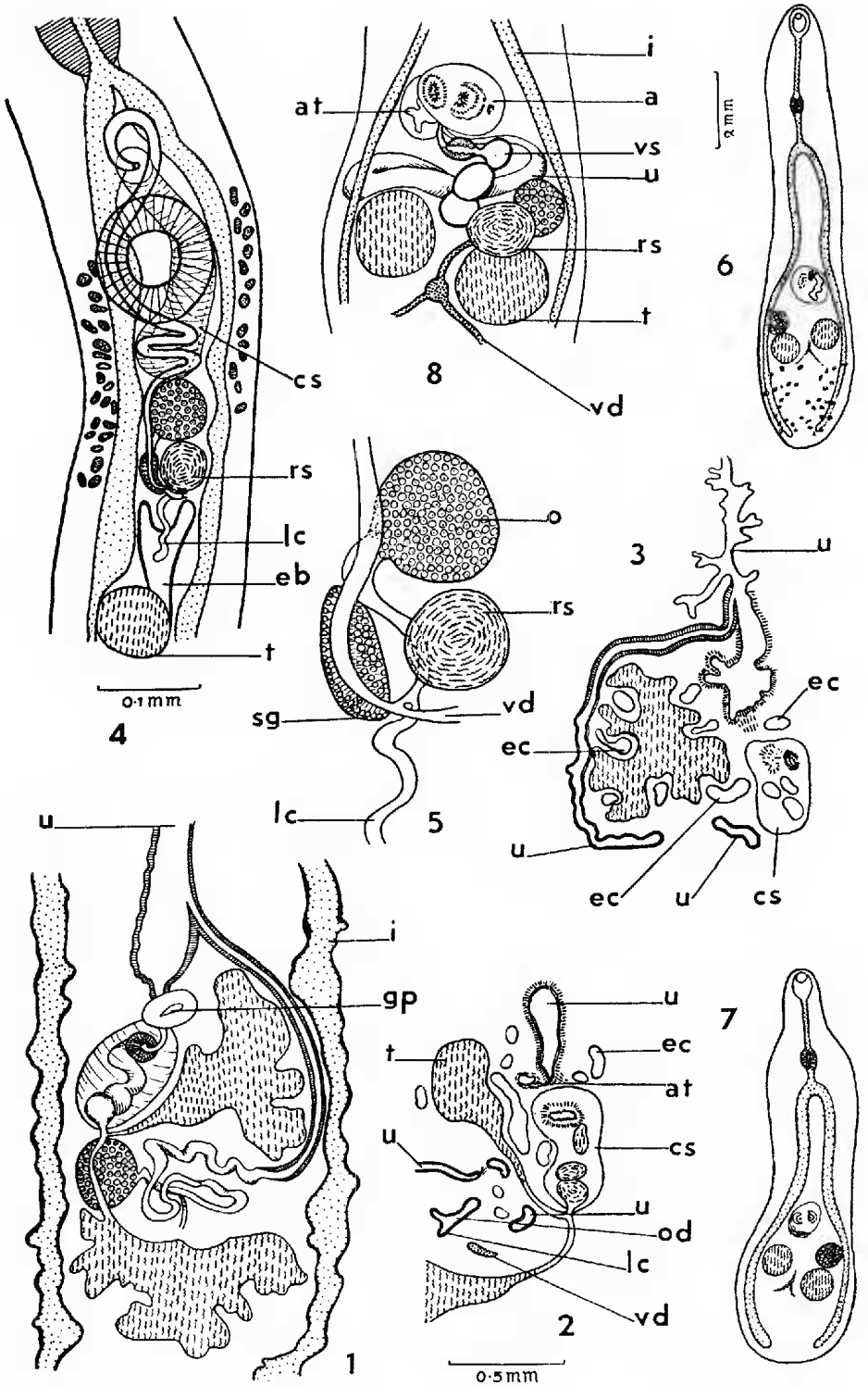
Fig. 1-3 *Clinostomum australiense:* 1, genital system (from S. J. Johnston's type); 2, part of L.H. Sect. to show relation of male ducts; 3, part of L.H. Sect. to show relation of uterus to other organs. Fig. 4-5 *Dolichosacculus solecarius* (from S. J. Johnston's type): 4, reproductive system, ventral view, only anterior vitellaria shown, cirrus sac and acetabulum indicated by dotting; 5, sketch, ventral view of female system. Fig. 6-8 *Stictodora diplacantha:* 6-7, entire worms, various organs omitted; 8, reproductive system, most of uterus omitted, dorsal view. Fig. 1, 2, 3 drawn to scale beside fig. 2; 4 and 8 to scale below 4; 6 and 7 to scale beside 6.

a, acetabulum; at, atrium; cs, cirrus sac; eb, excretory bladder; ec, excretory canal; gp, genital pore; i, intestine; lc, Laurer's canal; o, ovary; od, oviduct; rs, receptaculum seminis; sg, shell gland; t, testis; u, uterus; v, vitellaria; vd, vitelline duct; vs, vesicula seminalis.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serial sections has been made. Length, 11 mm.; maximum breadth (in the region of the gonads), 3·25 mm. The sucker ratio is nearly 1:2.

The excretory system is much more extensive than the figure indicates, and its ramifications extend from the extreme anterior to the extreme posterior end. The main canals and loops are well indicated in the original figure. The bifurcation of the very short terminal portion of the bladder lies very closely adjacent to the ends of the crura. Yamaguti (1933, 67, 69, and fig. 28), in his account of *C. complanatum* from Japanese *Nycticorax*, mentioned that the crura each opened into the excretory bladder. A study of longitudinal horizontal sections of *C. australiense* revealed the presence of a thin membrane separating the termination of each crus from the base of the corresponding arm of the bladder. Canals belonging to the excretory system are abundant in the tissues surrounding the testes, ovary and sex ducts. The caeca have very numerous short irregular diverticula. Gland cells are very abundant in the pre-acetabular region, both intra-caecally and extra-caecally.

The anterior testis is somewhat triangular and lies mainly on the left side. It measures about ·66 mm. across its base, and ·71 mm. in length. It is almost surrounded by the uterus and cirrus sac. Its vas deferens arises from the inner posterior corner as a thin-walled tube which travels nearly transversely to join the other vas deferens immediately before entering the cirrus sac. The posterior testis is transversely elongate and much lobed and extends almost from one crus to the other. Its maximum breadth is ·95 mm. and length ·45 mm. Its vas deferens arises from the part of the gland which lies just behind the ovary and travels more or less directly anteriorly to the cirrus sac. The vasa lie ventrally from the ovary. The cirrus sac is elliptical with broadly rounded ends, measures ·66 mm. in length by ·33 mm. in breadth and lies slightly obliquely on one side of the midline. Its posterior end is almost in contact with the ovary. It contains a wide twisted vesicula seminalis. The cirrus is short and provided with prominent blunt conical spines. There is a well marked genital atrium receiving the uterine aperture anteriorly, while the short male canal from the cirrus sac enters it on the opposite side. The genital pore is median and lies just behind the level of the front border of the anterior testes.

The ovary is almost circular in outline, being about ·3 mm. in diameter. It lies directly behind the cirrus sac. The oviduct issues from the mid-region of its inner surface and curves anteriorly and then posteriorly and inwardly. Mehlis' gland is inconspicuous. The main yolk duct enters the oviduct in its vicinity. Laurer's canal is an obvious structure in sections and terminates on the dorsal surface just in front of the level of the anterior border of the posterior testis. Yolk glands are scattered but are restricted, probably because of immaturity of the specimens, to the region in the vicinity of the posterior testis. The uterus is thrown into a number of short curves as it travels forwards from the ootype, making two transverse loops and then a longer third one just behind the anterior testis. It passes around the outer border of the latter on a more ventral level than the crus, and then curves inwards and forwards in front of the testis to enter the median uterus at a very acute angle. Johnston's figure of the uterus in the vicinity of the genital pore is not quite correct. The median uterus or uterine sac is thin-walled with muscular fibres, and has numerous short diverticula in the immature specimens examined. The sac extends forwards to a point distant behind the acetabulum equal to the length of the latter. The posterior portion of the sac is widened and then becomes constricted to join the atrium by means of a narrow muscular uterine canal.

Johnston has pointed out the chief differences between *C. australiense* and *C. marginatum* Rud. which is widely distributed in North and South America in

Ardeiform birds, its metacercaria occurring as cysts in various fresh water fish. The position of the uterus is more like that in *C. attenuatum* than that in *C. marginatum* and *C. complanatum* (Cort 1913). The only other known Australian species is *C. hornum* Nicoll 1914 from Ardeiform birds in North Queensland. The latter is probably a synonym of *C. complanatum*, as Yamaguti (1933, 71) has suggested.

Dolichosacculus solecarius (S. J. Johnston 1917) n. gen.

(Fig. 4-5)

This species is known from a single immature specimen taken from *Phalacrocorax melanoleucus* from Tuggerah, New South Wales. It was described and figured as *Dolichosaccus solecarius* by Johnston, but some details were not referred to adequately. As a result of an examination of the type slide, some additional structures have been seen.

The excretory bladder can be traced forwards as a rather wide tube above the two testes, almost to the region of the shell gland, where it bifurcates to terminate in two short broad arms ending at about the level of the middle of Mehlis' gland. It thus resembles that of *Opisthioglyphe*. The anterior margin of the pharynx bears four prominent rounded lobes. The oesophagus is practically absent.

Just behind the rounded ovary is the thin-walled spherical receptaculum seminis containing a number of ova, its diameter being ·42 mm. The oviduct arises postero-laterally from that part of the ovary which lies in front of the shell gland and travels back dorsally above the latter and part of the receptaculum. The shell gland lies laterally from the receptaculum and from the region just behind and between the two arises Laurer's canal which travels posteriorly in a sinuous course to terminate dorsally. A yolk duct can be seen joining the oviduct just before the latter enters the shell gland. The uterus, after leaving the shell gland, becomes thrown into a few short closely-arranged loops between the ovary and the posterior end of the acetabulum and immediately below the vesicula seminalis. It then crosses below the posterior portion of the cirrus sac, travels forward beside the latter, but on the opposite side, and then appears to be thrown into a wide loop below the anterior half of the cirrus sac. It continues forwards and, in front of the sac, it curves back to end at the female pore. The tracing of the course of the uterus has been difficult because of the extreme thinness of its walls, its unstained condition, and the absence of eggs. The cirrus and the terminal portion of the female duct are similar in their relations to those figured by Travassos (1930; fig. 24) for *Dolichosaccus rastellus*.

The systematic position of the species has remained uncertain. S. J. Johnston included it in his genus *Dolichosaccus* with some doubts, stating that it differed from the three known species, all of them from Australian frogs, in its cylindrical form, in the relative sizes of the two suckers, and in the topography of the vitellaria. The latter, in species from amphibians, are not restricted to the zone below and laterally from the crura but are widely distributed and occupy a broad post-ovarial zone; they also extend much further forward than in *D. solecarius* and may reach the level of the pharynx. The genus as originally diagnosed would include *D. solecarius*, except for the distribution of the yolk glands. Though Johnston stated that it was doubtful whether a receptaculum seminis was present in species of the genus (1912, 309), his type, *D. trypherus*, as figured by him (fig. 4), shows the presence of such an organ which he called a "fertilization space," and he actually called the organ a receptaculum seminis in his fig. 5 (*D. trypherus*), fig. 7 (*D. ischyrus*) and fig. 8 (*D. diamesus*). He regarded *Dolichosaccus* as being close to *Opisthioglyphe*. He placed it in the Plagiorchinae (1912); 1917).

Perkins (1928) allocated the genus to the Telorchiinae. He included it in his key to the subfamily and regarded the species described from Australian frogs as validly included in it and (p. 353) incorporated them in his key. He went on to state that another species placed in the genus, *D. parvula* Johnston (*sic*) 1916, was known only by a single very young specimen (from a bird, *Phalacrocorax*), which had an exceedingly short uterus containing only one large egg and which therefore should probably be removed to the Psilostominae. He did not include it in his key to species of *Dolichosaccus*. Perkins apparently confused S. J. Johnston's specific name, *solecarius*, with Nicoll's *Dolichopera parvula* which is also mentioned in the same paper. Johnston (1917, 220), in his original account, stated definitely that the uterus was short and did not extend back beyond the shell gland and that it contained no eggs. Perkins (1928, 343) thought that *Dolichosaccus* and *Brachysaccus* (both from Australian frogs) were probably not distinct, but an examination of Johnston's figures shows that in the latter the cirrus sac is shorter and lies in front of the acetabulum, Laurer's canal is very much larger, and the uterus is much more extensive, occupying most of the intercaecal space between the ventral sucker and the testes.

Travassos (1930, 2) when dealing with *Opisthioglyphe* and related genera, placed *Brachysaccus* under the former, and showed that Perkins' *Lecithopyge* was a synonym of *Dolichosaccus*. He gave a diagnosis of the last-named and included the presence of a spermatheca as one of the features (1930, 11). He did not include *D. solecarius* in the genus as he considered that its occurrence represented a case of accidental parasitism of the cormorant by a young specimen of a fish trematode near *Podocotyle* (Allocreadiinae), young flukes being more easily able to adapt themselves temporarily in a new host. In this connection it is of interest to mention that Miss Goss (1940) recorded the finding of an immature trematode, regarded as belonging to the Steringophoridae, in *Phalacrocorax varius* from Perth, Western Australia. The specimen was believed (no doubt correctly) to belong to a species infesting fish. Her account and figure suggest a member of the Azygiidae, such as *Azygia* sp., rather than a Steringophorid.

Mehra (1931, 175) allocated both *Dolichosaccus* and *Brachysaccus* to the Telorchiinae, placing the former (in his diagram) between *Cercorchis* and *Brachysaccus*. In a later paper (1937) he retained *Dolichosaccus* in that subfamily.

From the foregoing statements it will be seen that *D. solecarius* has been variously assigned. The appearance of the specimen suggests a member of the Telorchiinae, but the position of the uterus resembles that of many Allocreadiids. The form of the excretory bladder allocates the parasite to the Plagiorchioidea, so that membership of the Allocreadiidae can be definitely excluded.

The parasite from *Phalacrocorax* differs especially from typical species of *Dolichosaccus* in the distribution of the yolk glands. These are restricted to the vicinity of the caeca between the level of the ventral sucker and the end of the caeca and located especially laterally from the caeca, but they extend to lie ventrally to the latter, leaving the intercaecal field free from them.

The differences from *Dolichosaccus* may be best expressed by regarding *D. solecarius* as representing a new genus, *Dolichosacculus*, with the following characters: Telorchiinae; characters as in *Dolichosaccus* except that the body is more or less cylindrical and the vitellaria are restricted to the caecal and extracaecal regions behind the mid-acetabular level. Type *D. solecarius* (S. J. J.) from *Phalacrocorax melanoleucus*. The genus is close to *Dolichosaccus* and *Opisthioglyphe*.

The systematic relationships of *D. solecarius* suggest that its presence in a cormorant may be accidental and that its true host may be a frog, since all known species of *Dolichosaccus* and *Opisthioglyphe* occur in frogs. It may be mentioned

that the cercaria of a very common trematode, *Paryphostomum radiatum*, widely distributed in Australian cormorants, can infect tadpoles and thus reach its metacercaria stage (Johnston and Angel, 1942).

Paryphostomum radiatum (Duj.) Dietz

Distomum (*Echinostoma*) *radiatum* Dujardin 1845.
Paryphostomum radiatum Dietz 1909; 1910; Lühe 1909; Edwards 1927.
Echinochasmus tenuicollis S. J. Johnston 1917; T. H. Johnston 1918.
Paryphostomum testitrifolium Gogate 1934.
Paryphostomum phalacrocoracis Goss 1940.
Paryphostomum tenuicollis Johnston and Angel 1942.
Paryphostomum testrifolium Goss 1940, 5-6 (error for *testitrifolium*).

The first Australian reference to the parasite was that by S. J. Johnston who described it as *Echinochasmus tenuicollis* (1917, 206), the host being *Phalacrocorax melanoleucus* from New South Wales. He stated that the 19 dorsal spines were arranged in an uninterrupted row and varied little in size; the testes were three-lobed; the uterus little coiled; and the vitellaria terminated anteriorly some distance behind the ventral sucker. I identified it (1918, 212) from the same host species from the Thompson River, Western Queensland, and drew attention to the extension of the vitellaria as far forward as the level of the posterior edge of the acetabulum, as well as to the more anterior position of the male and female glands than was indicated in the original figure.

A recent examination of my material indicated that the species did not belong to *Echinochasmus* but to *Paryphostomum*, and it was under the name *P. tenuicollis* that the account of its life history and an extended host list were published by Johnston and Angel (1942). In South Australia it was ascertained that its molluscan hosts were the pond snails, *Amerianna pyramidata*, *A. pectorosa* and *A. tenuistriata*. It is probable that any Australian species of *Amerianna* (*Physa*, *Bulinus* and *Isodora* of Australian authors) would be able to serve as the molluscan host. The cyst stage was obtained experimentally in five species of aquarium fish, as well as in the tadpole of *Pseudophryne bibroni*, and was found occurring as natural infections in three species of fish from the Murray swamps at Tailem Bend, South Australia; *viz.*, *Carassius auratus* (golden carp), *Pseudaphritis urvilli* (congolli), and *Tandanus tandanus* (cat fish). The adult stage was recorded from the following species of cormorants in South Australia: *Phalacrocorax carbo*, *P. melanoleucus*, *P. fuscescens*, and *P. sulcirostris* (syn. *P. ater*). The arrangement of the collar spines in a double row was figured and the sizes published.

Miss Goss (1940) described *Paryphostomum phalacrocoracis* from *Phalacrocorax ater* and *P. melanoleucus* from the Swan River, Western Australia, and published a comparative table of various characters and measurements of *P. radiatum* (of Dietz and of Edwards) and *P. testitrifolium* Gogate.

A comparison of the accounts and figures published by Dietz, Edwards, Gogate and Goss indicates that they were all dealing with the same species, since the differences listed are only minor variations. A study of S. J. Johnston's type, as well as of my own material from Queensland, New South Wales, Victoria and South Australia, has permitted me to synonymize *P. tenuicollis* with *P. radiatum*.

A re-examination of the type specimen of *P. tenuicollis*, which is that figured by S. J. Johnston (fig. 5), shows that it is 2·47 mm. long by ·59 mm. in maximum breadth (somewhat compressed) and is immature and that the uterus contains only one egg. The latter is undersized, and has a colourless shell and lies adjacent to the shell gland. The structure of the female complex is essentially like that of *P. radiatum* as described by Edwards. The dorsal collar spines are arranged in

two series, those of the more anterior row being very slightly longer than those of the second row, the sizes being respectively ·09 and ·088 mm. The testes are trilobed but the anterior shows the presence of a small fourth lobe in front. The other details regarding its anatomy have been published by S. J. Johnston.

I have already stated that in Queensland material the vitellaria extended forwards to the acetabular level, and that the ovary and testes were situated more anteriorly than was indicated by S. J. Johnston. As a result of an examination of a large number of specimens from various Australian localities, it has been ascertained that the length of egg-bearing worms ranges between 2·4 and 5 mm., the maximum breadth being about one-fifth or one-sixth the length. Longer specimens (up to 5·8 mm. long) were collected, but they were relatively narrower (·6-·66 mm.) and in them the uterus was very long and narrow, extending back for 1·43 mm. behind the end of the acetabulum. Such specimens resemble that figured by Miss Goss (fig. 1). Most of our mature worms resembled closely those figured by Dietz and by Edwards.

Two series of collar spines are usually recognisable, especially mid-dorsally, but the interval between the two is generally slight. The sizes fall within the ranges listed by Miss Goss. The following sizes were observed. Spines of the anterior dorsal series measure about ·102 mm. long, those of the second series about ·092-·095 mm., the shoulder spines about ·107 mm.; the spine next to the group of corner spines, ·092-·097 mm. (this spine is in series with the posterior dorsal series), the corner spines are unequal in length the ventral inner being about ·112, ventral outer ·105, upper inner ·118, and upper outer ·136 mm., all these measurements being taken from heads lying in glycerin in a favourable position for measuring.

In mature worms the centre of the aperture of the acetabulum lies at about the end of the first fourth or fifth of the body length, while the posterior edge of that sucker is situated at about one-third of the body length from the anterior end of small mature specimens and at about two-fifths in the case of large adults.

The post-testicular region varies in relative length according to the age of the worm, and to some degree so also does the length of the preovarian region (measuring from the front of the ovary to the anterior end of the worm). The former lengthens with age and the latter diminishes. In specimens 1·3 mm. long post-testicular region was ·275-·33 mm., ratio of the latter to body length 1:4-4·6, preovarian region ·75-·99, ratio of the latter to body length 1:1·3-1·7; in a worm 2 mm. long these measurements and ratios were ·42, 1:4·7, 1·16, 1:1·7; in worms 2·6 to 2·7 mm. long they were ·53-·66, 1:4-5, 1·12-1·13, 1:2·3-3; in a worm 2·9 mm. long they were ·55, 1:5·3, 1·37, 1:2; and in a specimen 3·44 mm. in length they were ·99, 1:3·5, 1·5, 1:2·3 respectively. All the worms just referred to had not yet reached the egg-bearing stage, though the longer parasites had ovarian eggs in the oviduct and nearly all had sperms in the receptaculum seminis.

In S. J. Johnston's type (which had just entered egg-bearing, the first egg having entered the uterus), the post-testicular region was nearly one-fifth of the body length and the ovary was situated just behind the mid-body.

The longest worm observed which had not yet become egg-bearing was 2·97 mm. long and ·44 mm. wide at the acetabulum, but only ·3 mm. wide at level of the testes, the post-testicular region being 1:4·5 of the body length. It was probably somewhat macerated. The shortest specimens found with one or more eggs in the uterus were 2·4 mm. and 2·47 mm. long. The former had two eggs, poorly developed vitellaria, a postacetabular region 1·3 mm. long, and its post-testicular zone was 1:3·3 of body length. The other worm which was of the same length of the type specimen had six eggs, a postacetabular length of 1·49 mm., and

a post-testicular zone ·58 mm. long 1:4). In mature specimens with abundant eggs in a closely coiled uterus the latter occupies 1:3-3·8 of the body length. Miss Goss' figure indicates that in a very narrow worm 6 mm. long the latter region was 1:3·5 of the body length and that the preovarian length was one-eighth of the total. Dietz's figures show the post-testicular zone to be about 2:5 of body length in a worm 5·2 mm. long and 2:7 in one 6·8 mm. long. The testes are very variable in outline and, as stated by Dietz (1910), possess from three to seven or more lobes. The following indicates the conditions seen by us in the anterior and posterior testes respectively, minor lobulations being indicated after the plus sign: 3 + 1, 3; 3 + 2, 3 + 4; 3, 3; 5, 6 + 3; 4, 4; 4, 7; 4, 6; 3, 6.

The vitellaria extend forwards at least as far as the posterior border of the acetabulum in worms which are mature, but in specimens under 3 mm. in length the follicles usually do not reach more than half-way between the front of the ovary and the end of the acetabulum.

Edwards published an excellent account of the female complex. The receptaculum seminis is a conspicuous thin-walled structure appearing at first sight to be spherical, but if it be followed down ventrally it will be seen that it narrows only slightly to join the oviduct while its opposite side becomes somewhat pear-shaped to form eventually a very narrow ootype passing almost directly ventrally through the relatively large "shell gland," receiving the very narrow vitelline duct before entering. The uterus widens suddenly into a tube lying below the axis of the shell gland and then skirting the ovary or passing below it, travels forwards in a few loops which lie close together when the uterus is full of eggs. On reaching the posterior border of the acetabulum the tube becomes only slightly sinuous. The metraterm is well supplied with sphincter fibres. Laurer's canal arises from the receptaculum as a very narrow, rather thick-walled tube which, after a very short course, terminates on the surface above the region of the shell gland. The folded condition of the large vesicula seminalis is shown in Edwards' figure. The extended cirrus measures ·43 mm.

The short oviduct is very wide, and tapers rapidly before passing dorsally to become the receptaculum. The latter commonly contains masses of sperms. The transverse yolk duct skirts very closely the posterior edge of the shell gland. The yolk reservoir is usually conspicuous.

The form of, and space occupied by, the uterus vary with the sexual condition of the worm. When immature, it is only slightly sinuous and is relatively long (its course between the front of the ovary and the posterior edge of the acetabulum cup extending for more than one-fifth of the body length in the type specimen). It becomes more and more markedly coiled and folded when filled with eggs, and its course, as indicated above, may occupy only 1:25-35 of the body length. That part of it which lies below the ovary and shell gland has not been taken into consideration in connection with these measurements. There is thus a relative shortening of the postacetabular region occupied by the uterus, and associated with this alteration are the forward extension of the vitellaria and an increase in the length of the post-testicular zone.

S. J. Johnston reported that eggs measured ·084 by ·058 mm.; Dietz ·084-·088 by ·054-·061; Edwards ·08-·1 by ·05-·064; Johnston and Angel ·07-·084 by ·058-·063. The longest I have measured was ·092 by ·063.

Amongst the material studied were numerous immature stages. The smallest obtained from cormorants were excysted metacercariae measuring only ·28 mm. long by ·1 to ·12 mm. in maximum width, with the almost hemispherical acetabulum in the posterior third of the body. The size of the metacercarial stage was not mentioned by Johnston and Angel (1942), but their figure indicates a long narrow form, ·32 mm. in length, ·07 mm. wide at the acetabulum, the latter being ·03 mm. wide, ·05 mm. long, and situated at mid-length.

The following measurements in millimetres of a series of specimens ranging from metacercariae to worms which had not yet reached the egg-bearing stage indicate the relative lengthening of the acetabulum, and the post-acetabular region in relation to the increasing length of the parasite: (i) total length; (ii) breadth at acetabulum; (iii) length of acetabulum (*i.e.*, from front edge to posterior end of base; (iv) breadth of acetabulum; (v) distance from front edge of acetabulum to head end (*i.e.*, pre-acetabular length); (vi) distance from posterior end of base of acetabulum to end of worm (*i.e.*, post-acetabular length); (vii) approximate ratio of (v) to (vi); (viii) length from centre of aperture of acetabulum to head end; (ix) length from centre of aperture of acetabulum to end of body; (x) approximate ratio of (viii) to (ix).

	i	ii	iii	iv	v	vi	vii	viii	ix	x
1	·28	·1	·06	·06	·16	·06	8:3	·19	·09	2:1
2	·46	·13	·12	·10	·19	·14	10:7	·24	·23	1:1
3	·51	·17	·13	·11	·24	·13	2:1	·30	·21	3:2
4	·58	·18	·15	·13	·26	·15	5:3	·32	·25	4:3
5	·66	·16	·14	·12	·26	·23	10:9	·32	·33	1:1
6	·87	·27	·25	·20	·32	·30	1:1	·40	·47	5:6
7	·88	·23	·15	·15	·31	·52	3:5	·37	·51	3:4
8	1·25	·42	·32	·28	·36	·57	5:8	·45	·80	1:1·8
9	1·30	—	·33	—	·33	·64	1:2	—	—	—
10	1·32	—	·35	—	·44	·88	1:2	—	—	—
11	1·32	·35	·30	·27	·43	·57	3:4	·54	·80	1:1·5
12	1·80	·40	·38	·32	·60	·80	3:4	·68	1·12	1:1·7
13	1·98	—	·42	—	·55	1·43	1:2·6	—	—	—
14	2·64	·55	·44	·55	·58	1·54	1:2·6	—	—	—
15	2·69	·44	·55	·42	·62	1·54	1:2·5	—	—	—
16	2·91	·53	·55	·42	·55	1·76	1:3·2	—	—	—
17	3·44	·55	·58	·41	·66	2·20	1:3·3	—	—	—

Paryphostomum radiatum is now known to occur in the following Australian localities (including those now recorded) and species of cormorants: *Phalacrocorax melanoleucus*—Brisbane and Longreach, Queensland; Tuggerah, New South Wales; Gippsland, Victoria; Tailem Bend, South Australia; and Perth, Western Australia. *P. sulcirostris*—Burnett River, Queensland; Glenelg River, Victoria; Tailem Bend and Adelaide, South Australia; Perth, Western Australia. *P. carbo novae-hollandiae*—Burnett River, Queensland; Bathurst, New South Wales; Tailem Bend and Hope Valley, South Australia. *P. fuscescens*—Tailem Bend. The only Australian species from which the trematode has not been obtained is *P. varius*, a cormorant restricted to a coastal habitat. It appears probable that *Paryphostomum radiatum* is a parasite associated with swamps and rivers rather than marine environments.

Dietz (1910) recorded it from *P. carbo* from Central Europe, and Edwards (1927) from the same species from Wales. Yamashita (1938, 1085) reported it from *P. carbo hanedae* from Japan. Yamaguti (1939, 143-4) gave a brief account of specimens from the latter host species, as well as from *P. capillatus*, both from Japan. Gogate's *Paryphostomum testitrifolium*, stated to have been taken from a Burmese tree-duck, *Dendrocygna javanica*, agrees so closely with *P. radiatum* that it should be placed in synonymy.

Petasiger exaeretus Dietz

This minute echinostome has been found in *Phalacrocorax carbo* from Tailem Bend, South Australia, and from Bathurst, New South Wales; *P. melanoleucus* and *P. sulcirostris* from Tailem Bend. S. J. Johnston's type slide of *Dolichosaccus*

solecarius from *P. melanoleucus* from Tuggerah, New South Wales, contains a specimen of *Petasiger exacretus*.

The dimensions and certain other features differ markedly from those given by Dietz (1910) whose material came from *P. carbo* from Europe, but they agree sufficiently closely with the measurements given by Davies (1934) for specimens from *P. carbo* from Wales. The following account is based on specimens from South Australia.

Length 1·2-1·3 mm., but up to 1·76 mm. in worms with very elongated preacetabular region; maximum breadth (at the acetabulum) ·31-·38 mm.; width of the head collar ·23, and of the neck ·17-·18. In a worm 1·3 mm. long and ·34 mm. in breadth, the gonads were fully developed but no egg was present; while in another of similar dimensions (1·2 mm. long by ·35 mm. in maximum width) there were five eggs. The preacetabular region of the body is covered by abundance of scales. The oral sucker is more or less circular, ·04-·06 mm. long by ·04-·07 mm. wide; the acetabulum is almost circular in outline, ·18-·24 mm. wide by ·19-·25 mm. long. The ratio of breadths of the two suckers is 1:3-3·5; and of lengths 1:3-5, usually about 1:3. The distance from the anterior border of the acetabulum to the head end of the worm, *i.e.*, the preacetabular length, is approximately half the body length, the ventral sucker lying wholly in the posterior half. The postacetabular length (*i.e.*, measuring from the hinder border of the acetabulum to the end of the worm) is about one-third of the total length. There are 27 spines including the two corner groups, each with four. The larger pair of corner spines are about 75-77 μ long and the other pair about 60-70 μ, the width being 12-13 μ. The first lateral spine is the smallest and narrowest in the series; it measures 35-40 μ long and may overlap the corner spines. The remaining laterals are 57-65 μ long, the length increasing as they approach the dorsal surface. The dorsal spines are arranged in two series, those of the anterior series being much shorter (36-42 μ long) and narrower (4 μ broad) than those of the second group (45-55 μ by 6-7·5 μ), the shortest and thinnest in the groups being those nearest the mid-dorsal region. All spines are rather pointed, especially the dorsal series.

The prepharynx is about ·05 mm. long; the pharynx ·076-·08 mm. long by ·034-·04 mm. wide; and the oesophagus ·27-·3 mm. long. The crura extend almost to the end of the worm.

The testes are tandem, slightly elongate transversely, especially the anterior, the posterior being usually rather narrower and longer than the other. The dimensions are ·19-·22 mm. broad by ·1-·15 mm. long. The thin-walled cirrus sac lies somewhat obliquely on one side in the region between the crura and the acetabulum, and extends back above or beside the anterior third of the latter. It measures about ·14 by ·05 mm. and its posterior half is occupied by the folded seminal vesicle. The genital aperture is immediately behind the intestinal bifurcation.

Davies has given a good account and figure of the female complex. The ovary is about ·075 mm. in diameter and lies to one side of the midline. The receptaculum is closely associated with the shell gland and is of about the same size but rather less regular in shape. It lies between the ovary and shell gland, and is approximately in the median line. The course of the uterus is similar to that described by Davies, as also is that of the yolk ducts and yolk reservoir. The yolk follicles do not extend forwards much beyond the mid-level of the acetabulum. They may invade the edges of the testicular field to a slight extent.. The arrangement is the same as that given by Davies and unlike that described and figured by Dietz. The uterus is very short, forming a loop in the vicinity of the ovary and then travelling forwards, parallel with the cirrus sac. In some specimens the thicker-walled vaginal portion is greatly dilated into a more or less spherical structure several times the size of the cirrus sac and filled with a darkly-staining secre-

tion. Eggs measure ·055-·09 by ·055-·067 mm. The maximum number seen in the uterus was nine, but there were usually 1-5.

Petasiger exacretus has been recorded by Dietz from Central Europe and by Davies from Wales, in both cases from *Phalacrocorax carbo*. Yamashita (1938) reported its presence in *P. carbo hanedae* in Japan. Its known range is now extended to include south-eastern Australia.

Hysteromorpha triloba (Rud.)

Distoma trilobum Rud. 1819.
Hemistomum trilobum Dies 1850; Lühe 1909; Krause 1914.
Proalaria triloba La Rue 1926; Ciurea 1930.
Diplostomum trilobum Hughes 1929; Ciurea 1933.
Hysteromorpha triloba Lutz 1931; Dubois 1938; Yamaguti 1939.
Diplostomum granulosum Goss 1940.

The only Australian record of this diplostome was that of Miss Goss (1940, 6-7) who described it as *Diplostomum granulosum* from *Phalacrocorax ater* from Perth, Western Australia. I have obtained it from *P. carbo novae-hollandiae* from Tailem Bend, South Australia, and Bathurst, New South Wales; *P. melanoleucus* from Tailem Bend, and Glenelg River, Victoria; *P. sulcirostris* (*ater*) from Tailem Bend; and *P. fuscescens* (Tailem Bend). A comparison of the accounts and figures published by Krause (1914), Lutz (1931), and especially those by Dubois (1938), Ciurea (1930) and Yamaguti (1939), with the Australian material and with Miss Goss' account, indicates that *H. triloba* is a very widely distributed species, now being known from *P. carbo* from Austria and Roumania; *P. pygmaeus* from Roumania; *P. auritus* from Minnesota, U.S.A.; *P. brasiliensis* from Brazil; *P. carbo hanedae* from Japan; and from the four Australian species mentioned above.

Eggs from my material measured ·085-·093 mm. by ·060-·068, most of them being ·087-·090 by ·063-·065 mm. Yamaguti gave the dimensions as ·092-·105 by ·06-·069; Goss ·086 by ·085, but her figures indicate ·07-·08 by ·07-·50 mm.; Dubois ·097-·099 by ·052-·062; Ciurea ·075-·099 by ·048-·075 mm. Lutz (1931) and Ciurea (1930; 1933) have published information relating to stages in the life history of the species.

Echinoparyphium phalacrocoracis Yamaguti

This small trematode was described recently by Yamaguti (1939, 142) from the Japanese cormorants, *P. carbo hanedae* and *P. capillatus*. I have collected it from *P. carbo novae-hollandiae*, *P. sulcirostris* and *P. melanoleucus* from Tailem Bend. Very few specimens were present on the few occasions that the parasite was obtained.

The narrow body measures 1·6-2·1 mm. by ·29-·22 mm. in maximum width (at the acetabulum). The head is somewhat pointed, ·15-·17 mm. wide, not sharply marked off from the neck which at the level of the pharynx measures ·16 to ·2 mm. There is little variation in width from the region of the genital pore to that of the posterior testis. The oral sucker is nearly spherical, measures ·06-·08 mm. long by ·06-·07 mm. wide. The acetabulum is ·17 mm. long by ·16 mm. wide and lies at the end of the first third and anterior part of the middle third of the body length. The preacetabular length (measuring from the front edge of the organ) is 1:2·6-2·7 of body length, and the postacetabular length (measuring from the posterior edge of the base of the organ to the end of the worm) 1:1·86-1·9 of body length. The sucker ratio is 1:2·3-2·6 for breadths and 1:2·1-2·8 for lengths. The distance between the centres of the apertures of the suckers is ·64-·77 mm., i.e., 1:2·5-2·6 of body length. The genital pore lies

about ·07-·14 mm. in front of the acetabulum and a short distance behind the intestinal bifurcation. There are 27 collar spines, including the two end groups each comprising four. The latter are 57-63 μ long by 8-10 μ wide. The lateral spines are much shorter but vary in length (36-42 μ). The dorsal spines are arranged in two distinct alternating series, those of the anterior row being 25-29 μ and those of the second row 36-38 μ long.

The narrow prepharynx measures ·075-·09 mm. long; the pharynx ·065-·07 mm. long by ·05 mm. wide; and the narrow oesophagus ·30-·35 mm. long. The caeca extend almost to the posterior end.

The two rounded testes are arranged tandem and are of approximately the same size, ·16-·18 mm. diameter, and lie in the posterior half of the body. The cirrus sac is large, about ·17-·2 mm. long by ·11 mm. wide, somewhat obliquely placed behind the intestinal bifurcation and extending back above the anterior half of the acetabulum. Most of the sac is occupied by the voluminous vesicula seminalis which forms a few short curves. The prostatic region is inconspicuous.

The ovary is ·05-·07 mm. in diameter and lies on one side of the median line at approximately mid-length of the body. The receptaculum seminis is immediately behind, and slightly inwardly from, the ovary, so that its position is approximately median. Laurer's canal lies above it and the shell gland which is somewhat obliquely placed. The short uterus forms a few loops and contains very few eggs. The latter measure ·08-·09 by ·06-·065. Vitellaria extend from the posterior end of the worm almost to the mid-acetabular level, and encroach very little on the testicular field though they occupy most of the post-testicular region. The large yolk reservoir lies adjacent to the front edge of the anterior testis.

Stictodora diplacantha n. sp.

(Fig. 6-8)

Many specimens of this small Heterophyid were obtained from cormorants, *Phalacrocorax varius*, from Port Gawler, South Australia. Length. ·8-1·14 mm.; maximum breadth, ·21-·29 mm.; the usual dimensions being ·99-1·05 by ·21-·4 mm. The longest worms are relatively the narrowest. Extreme anterior end narrowed; posterior broadly rounded. The breadth is fairly constant in the anterior two-thirds of the body, being about ·17 mm., widening from the level of the genital atrium to reach the maximum in the region of the ovary and testes. In some specimens there may be a constriction in the prepharyngeal region, and also a slight waist in front of the atrium. The body is beset with delicate sharp spines, these being especially abundant as far back as the level of the posterior testis in some cases, of the ovary in others, while in others they do not reach the region of the pharynx. The rest of the body bears extremely minute spines, the surface being almost smooth.

The oral sucker is ventral, subterminal, ·061-·065 mm. long and ·538 mm. wide. The prepharynx is relatively long, ·145-·153 mm. in length; pharynx ·044-·046 mm. long by ·029-·031 wide; and the oesophagus ·047-·086 mm. in length. The crura extend almost to the end of the worm and lie close to the lateral border of the body in the post-atrial region. The distance from the crural bifurcation to the head end of the worm is 1:3-3·2 of the body length.

The genital atrium, together with the highly modified acetabulum, is a conspicuous structure in cleared specimens. It is often slightly oblique; its measurements are, length ·065-·067 mm., breadth ·092-·1 mm. Its front edge is distant from the head end 1:1·6-1·7 of the total body length, so that the whole organ lies at the end of the middle third of the body. The acetabular portion contains two well-defined gonotyls, not quite equal in size, one of them (that on the ovarian side of the worm) being more ventrally placed than the other. These gonotyls

are similar in structure, each having about 18 strongly curved, sharply-pointed hooks arranged in two series—a basal row of 12-15 (13-14) smaller hooks and a group of five or six much larger central hooks, 17-21 μ long. The specific name is based on the double gonotyl with its prominent armature. The actual atrium has, when at rest, strongly folded walls and into it open the sex ducts. The genital pore is not quite median, being displaced away from the ovarian side of the worm.

The testes are similar, ·077-·09 mm. in diameter, with an entire margin, and situated in the intercaecal region in the posterior third of the body. The anterior testis is at about the same level as the ovary, but on the opposite side. The posterior testis lies behind the ovary but is more medially situated. The thin-walled vesicula seminalis is constricted into three spherical structures, each about ·05-·08 mm. in diameter. The most posterior lies more or less median between the ovary and the testes and is below the receptaculum seminis; the other two are situated between it and the atrium. The third portion lies adjacent to, or immediately above, the short thick-walled prostate region of the male duct, which is ·048 mm. long by ·03 mm. wide and is succeeded by the narrow male canal, about ·04 mm. long by ·012 mm. wide. The latter enters the posterior or postero-lateral region of the atrium.

The ovary is approximately spherical, ·05-·12 mm. in diameter, situated on one side of the median line, and distant from the head end 1:1·4 of the body length, *i.e.*, it lies in the posterior third of the worm. The oviduct arises from its inner surface. The receptaculum seminis is relatively large, its diameter (·07-·1 mm) at times exceeding that of the ovary. It partly overlies the latter and may also extend above part of the posterior testis and even reach the edge of the other testis. Below it is part of the vesicula seminalis. The uterus occupies most of the available space in the region behind the atrium and underlies the crural region (in part), testes, receptaculum, vesicula and even part of the ovary. Its terminal portion is more or less transversely placed in front of the gonads, becoming very narrow as it passes forwards just below the male duct to enter the atrium. The scattered vitelline follicles occupy a very thin zone dorsally and ventrally in the post-testicular region and reach almost to the end of the worm. The two main ducts travel forwards and inwards, one of them lying close behind the posterior testis, the two ducts joining to form the small yolk reservoir, about midway between the two testes and situated behind the receptaculum. The common yolk duct travels forwards to terminate below the latter. Eggs are very numerous, ·032-·033 by ·015-·017 mm. in size, with a slight narrowing towards the opercular end, and sometimes a minute projection marks the edge of the operculum.

A slide containing the type and several paratypes has been deposited in the South Australian Museum. The species resembles *Stictodora japonica* Yamaguti (1939, 175) more closely than any other yet described, but differs from the Japanese parasite in body proportions, relative lengths of the oesophagus and prepharynx, relative position of the testes, structure of the acetabular region and the position of the latter in relation to the body length. Ciurea (1933, 108) placed the genus in the Galactosominae.

Australian Hosts and Parasites recorded in this Paper

Anhinga novae-hollandiae Gould

Clinostomum australiense S. J. Johnston, Burnett River, Qld.

Phalacrocorax carbo novae-hollandiae Stephens

Paryphostomum radiatum (Rud.), Burnett River, Qld.; Bathurst, N.S.W.; Tailem Bend and Hope Valley, S. Aust.

Echinoparyphium phalacrocoracis Yamaguti, Tailem Bend, S. Aust.

Petasiger exaeretus Dietz, Bathurst, N.S.W.; Tailem Bend, S. Aust.

Hysteromorpha triloba (Rud.), Bathurst, N.S.W.; Tailem Bend, S. Aust.

PHALACROCORAX MELANOLEUCUS Vieillot
Paryphostomum radiatum (Rud.), Brisbane and Longreach, Qld.; Tuggerah, N.S.W.; Gippsland, Vict.; Tailem Bend, S. Aust.; Perth, W. Aust.
Echinoparyphium phalacrocoracis Yam., Tailem Bend, S. Aust.
Petasiger exacretus Dietz, Tuggerah, N.S.W.; Tailem Bend, S. Aust.
Hysteromorpha triloba (Rud.), Glenelg River, Vict.; Tailem Bend, S. Aust.
Dolichosacculus solecarius (S. J. Johnston), Tuggerah, N.S.W.

PHALACROCORAX SULCIROSTRIS Brandt (syn. *P. ater* Lesson)
Paryphostomum radiatum (Rud.), Burnett River, Qld.; Glenelg River, Vict.; Tailem Bend, Adelaide, S. Aust.; Perth, W. Aust.
Echinoparyphium phalacrocoracis Yam., Tailem Bend, S. Aust.
Petasiger exacretus Dietz, Tailem Bend, S. Aust.
Hysteromorpha triloba (Rud.), Tailem Bend, S. Aust.; Perth, W. Aust.

PHALACROCORAX VARIUS Gmel.
Stictodora diplacantha n. sp., Port Gawler, S. Aust.

PHALACROCORAX FUSCESCENS Vieillot (syn. *P. gouldi* Salv.)
Paryphostomum radiatum (Rud.), Tailem Bend, S. Aust.
Hysteromorpha triloba (Rud.), Tailem Bend, S. Aust.

MELEAGRIS GALLOPAVO Linn. (Turkey)
Echinoparyphium recurvatum (Linst.), Melbourne, Vict.

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